PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Form PCT/IPEA/416
pct04a0001		

International application No.	International filing date (day/month/year)	Priority date (day/month/year)
PCT/JP2005/004452	14.03.2005	30.03.2004

International Patent Classification (IPC) or national classification and IPC

G06F7/24, G06F19/00

Applicant

FUJITA, Osamu

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of **3** sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

    a. ☒ *(sent to the applicant and to the International Bureau)* a total of **8** sheets, as follows:

        ☒ sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).

        ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

    b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s))

        _____ , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

    ☒ Box No. I   Basis of the report

    ☐ Box No. II   Priority

    ☐ Box No. III   Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

    ☐ Box No. IV   Lack of unity of invention

    ☒ Box No. V   Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

    ☐ Box No. VI   Certain documents cited

    ☐ Box No. VII   Certain defects in the international application

    ☐ Box No. VIII   Certain observations on the international application

Date of submission of the demand	Date of completion of this report
Name and mailing address of the IPEA/JP	Authorized officer
Facsimile No.	Telephone No.

Form PCT/IPEA/409 (cover sheet) (January 2004)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/JP2005/004452

| Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |

1. Statement

Novelty (N)   Claims 2-4 _____ YES

                           Claims _____ NO

Inventive step (IS)   Claims 2-4 _____ YES

                           Claims _____ NO

Industrial applicability (IA) Claims 2-4 _____ YES

                           Claims _____ NO

2. Citations and explanations (Rule 70.7)

Document 1: JP 10-091450 A (Nippon Telegraph And
            Telephone Corp.), 10 April 1998

Document 2: JP 11-259444 A (Toshiba Corp.), 24 September
            1999

Document 3: JP 2000-163392 A (Mitsubishi Electric Corp.),
            16 June 2000

      The inventions set forth in claims 2 to 4 are not
disclosed in any of the documents that are cited in the
international search report, and would not have been
obvious to a person skilled in the art.

Box No. I	Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on translations from the original language into the following language _____ ,
which is the language of a translation furnished for the purposes of:

☐ international search (Rule 12.3 and 23.1(b))

☐ publication of the international application (Rule 12.4)

☐ international preliminary examination (Rule 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

☐ the international application as originally filed/furnished

☒ the description:

pages ___1, 3, 5, 7, 9–12, 14, 16–17___ as originally filed/furnished

pages* ___2, 4, 6, 8, 13, 15___ received by this Authority on ___02.09.2005___

pages* _____ received by this Authority on _____

☒ the claims:

nos. ___3___ as originally filed/furnished

nos.* _____ as amended (together with any statement) under Article 19

nos.* ___2, 4___ received by this Authority on ___02.09.2005___

nos.* _____ received by this Authority on _____

☒ the drawings:

sheets ___1/13–13/13___ as originally filed/furnished

sheets* _____ received by this Authority on _____

sheets* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☒ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☒ the claims, nos. ___1___

☐ the drawings, sheets/figs _____

☐ the sequence listing *(specify):* _____

☐ any table(s) related to sequence listing *(specify):* _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____

☐ the claims, nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing *(specify):* _____

☐ any table(s) related to sequence listing *(specify):* _____

*   *If item 4 applies, some or all of those sheets may be marked "superseded."*

AMENDMENT

To: Commissioner of the Patent Office

1. Identification of the International Application
   PCT/JP2005/004452

2. Applicant
   Name: FUJITA Osamu
   Address: 3-15-1-5-407, Suzaku, Nara-city, Nara 631-0806 Japan
   Country of nationality: JAPAN
   Country of residence: JAPAN

3. Agent
   None

4. Item to be Amended
   Description and Claims

5. Subject Matter of Amendment

   (1) The expression " As a scheme of parallel computation" which appears on page 2
       line 5 of the description should be amended as "In a similar technical field of the
       present invention", "periodically" which appears on page 4 line 6 and 8 should be
       deleted, "SUBSEQUENT" of "37 SUBSEQUENT WRITE CONTROL CIRCUIT"
       which appear on page 6 line 10 should be deleted, "this oop" which appear on page
       8 line 1 should be corrected as "this loop", "greater" which appears on page 13 line
       4 should be corrected as "lower", "Pin" which appears on page 15 line 1 should be
       corrected as "P(6)", "Pin=30" which appears on page 15 line 3 should be amended
       as "P(4)=33".

   (2) Paragraph 1 on page 18 of the claims should be deleted, paragraph 2 on page 18 and
       paragraph 4 on page 14 which depend from paragraph 1 should be amended to clear
       description. However, there is no substantial change in the subject matters of
       paragraph 2 and 4.

6. List of Attached Documents

   (1) Replacement sheet of page 2, 4, 6, 8, 13 and 15 of the description
   (2) Replacement sheet of page 18 and 19 of the claims

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* Please note that this is an English translation of the "AMENDMENT" filed in Japan. So the page and line
  numbers are the ones of the Japanese language application.

physical systems, there is a drawback in that the proportion of costs for calculation of priority order to the cost for data processing for each component is higher and thus calculation efficiency does not improve much.   In a similar technical field of the present invention, there is an invention in which a scheduler schedules multiple processes into multiple processors, such as a parallel computing system of patent document 1, for example.   However, the invention is for load distribution and thus cannot be applied to a process of minutely dividing calculation of each component in simulation calculation.   Although an apparatus that arranges data by hardware at high speeds is already invented, such as a sorting apparatus of patent document 2, the apparatus does not have a mechanism for rearranging the data by importance and thus cannot be used in terms of an object of the present invention.

Patent Document 1: Japanese Patent Application Laid-Open No. 11-3321

Patent Document 2- Japanese Patent Application Laid-Open No. 11-305993

DISCLOSURE OF THE INVENTION
PROBLEMS TO BE SOLVED BY THE INVENTION
[0005] For example, in the actual physical phenomenon or social phenomenon, there may be a case in which only a part of components changes at a given time and there is almost no change in other majority of the components.   In addition, there are cases where

remaining, an arithmetic unit capable of performing an arithmetic process on importance data in each register is provided. By using the arithmetic unit to add a certain value to each data or perform a bit shift or multiplication on each data, importance data is rewritten to greater values maintaining the order relationship between the data, whereby an adjustment can be made such that the importance of old data is increased and data processing is performed. In contrast, by rewriting importance data to smaller values, an adjustment can also be made such that old data can be deleted as soon as possible.

[0010] In order to omit wasted data processing for a component having little change, in a storage apparatus, a plurality of candidate value data are held for each of a plurality of component data. The data processing apparatus regards a statistic of a plurality of candidate values of a component as a representative value of the component data and performs a calculation process on each component data to calculate an updated value for each component data, and then replaces a candidate value that differs most greatly from an updated value with the updated value. As the statistic for this case, an average value, a median value, or the like is used. Then, the important component selection apparatus regards the magnitude of variation in candidate values for a component data as an importance of that component data and selects an important component based on an order of magnitude of variation in candidate values. The reason that variation in candidate values is regarded as importance is that by that it is possible to indicate conditions where

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component data and a processing task in the sixth embodiment.

DESCRIPTION OF THE REFERENCE NUMERALS

[0014] 11, 12, 31, 41, 51, and 61: DATA STORAGE APPARATUS

12, 22, 32, 42, 52, and 62: DATA PROCESSING APPARATUS

13, 23, 33, 43, 53, and 63: IMPORTANT COMPONENT
SELECTION APPARATUS

34: MEMORY INPUT/OUTPUT CONTROL CIRCUIT

35: DATA TRANSFER CONTROL CIRCUIT

36: FIFO BUFFER REGISTER

37: WRITE CONTROL CIRCUIT

38: STORAGE ELEMENT

39: DATA SELECTOR

410: REGISTER

420: DATA ARRANGEMENT CONTROL CIRCUIT

421: COMPARATOR

422: SELECTOR/ARITHMETIC UNIT

423: MAGNITUDE COMPARATOR

424: MATCH COMPARATOR

425: DATA SELECTOR

426: ARITHMETIC UNIT

427: OUTPUT SELECTOR

BEST MODE FOR CARRYING OUT THE INVENTION

[0015] Embodiments of the present invention will be described

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data processing for the component i.   For a specific data processing, an appropriate program can be made as software for the data processing apparatus 12 according to the application purpose.   In this process, not only the component i but also any other one or more

5   components, for example, a component j, can be updated.   For a component to be updated, importance of that component is calculated. After this, the importance and component number(s) of a component(s) to be updated are sent out to the important component selection apparatus 13 and an updated value(s) of the component(s)

10   is/are sent out to the data storage apparatus 11.   When a series of these processes is completed, immediately, the most important component is read from the important component selection apparatus 13 and the same processes are repeated.   The data processing apparatus 12 continuously performs this loop process until a

15   termination condition which is set by the program is reached.
[0020] When a component identifier (component number) of the highest importance has been read by the data processing apparatus 12, the important component selection apparatus 13 deletes the data and moves other component identifiers up one position.   Each time a set

20   of input data on importance and a component number is inputted from the data processing apparatus 12, the important component selection apparatus 13 arranges the input data according to the order of importance.   Let $P(k)$ be the value of importance of data in k-th position in the arrangement and let Pin be the value of importance of

25   the input data.   Since $P(k)$ is already arranged in such an order that

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convenience it may be regarded such that $Ks=n+1$.

[0033] In the case of PUSH, when a condition is such that a value Pin of the importance of input data Din is lower than or equal to a value $P(k)$ of the importance of data $R(k)$ in the register k, i.e., $P(k) \geq Pin$,

5   $R(k)$ does not need to be changed and thus a selector/arithmetic unit output is $R(k)$. This condition is indicated only by a comparator output $G(k)=0$ and does not depend on other comparator outputs and thus $G(k-1) = *$, $G(k+1) = *$, $S(k) = *$, and $LS(k) = *$. Conditions such that $P(k-l) \geq Pin > P(k)$ and $k \leq Ks$ are conditions for an

10   insertion location of Din. Specifically, they are indicated by $G(k-1)=0$, $G(k)=1$, $G(k+1) = *$, $S(k)= *$, and $LS(k)=0$ and a selector/arithmetic unit output to the k is Din. Conditions such that $Pin > P(k-l) \geq P(k)$ and $k \leq Ks$ indicate that $R(k)$ has lower importance than Din and $P(k) \geq P(Ks)$, and thus, $R(k)$ should be

15   moved down one position by the insertion of Din. That is, under conditions that $G(k-1)=1$, $G(k)=1$, $G(k+1) = *$, $S(k) = *$, and $LS(k)=0$, $R(k-1)$ which is one position above is assigned to $R(k)$, and thus, the selector/arithmetic processing output is $R(k-1)$. In the case in which $k>Ks$, even if Din is inserted, $R(Ks)$ is deleted and thus it indicates a

20   condition that the position does not change. In the case also in which Din is not inserted, the position does not change and thus this does not depend on a value of importance, and under conditions that $G(k-1) = *$, $G(k) = *$, $G(k+1) = *$, $S(k) = *$, and $LS(k)=1$, a selector/arithmetic unit output is $R(k)$.

25   [0034] In the case of POP, in a condition that $P(k) \geq P(k+l) \geq Pin$, i.

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preparations so that the second important data can be outputted.
Since an insertion operation of input data and an output operation can
be simultaneously processed in one machine cycle, an arrangement of
data by importance can be performed at high speeds.

5   [0037] A specific example of the operation for such a case is shown
in FIGs. 15, 16, and 17. Each of them follows the rules in FIG. 14.
FIG. 15 shows the case of PUSH. Since input data Din (Pin=60) is
inserted between P(3)=60 and P(4)=33, Din is assigned to R(4) and
so R(4) and R(5) move to R(5) and R(6), respectively. A

10   component identifier 555 of R(6) is the same as that of the input data
and the importance is as low as P(6)=15, and thus, R(6) is deleted.
R(7) and R(8) do not change. FIG. 16 shows the case of POP when
the same input data is present. After R(1) has been read, each R(2)
and R(3) having an importance of 60 or higher move up one position.

15   Importance P(4)=33 of R(4) is lower than that of the input data and
thus Din is inserted in R(3) and the position of R(4) does not change.
R(5) does not change, either. R(6) has the same component
identifier as the input data and has lower importance and thus is
deleted. Hence, lower order R(7) and R(8) move to R(6) and R(7),

20   respectively. Data in the lowest order R(8) is cleared. This
corresponds to the case that the importance is a minimum value of
zero and the component identifier is NULL. FIG. 17 shows the case
of POP. Since the importance of input data is Pin=7 and is lower
than the importance P(6)=15 of R(6) that stores the same component

25   identifier as the input data, the input data is not inserted and

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CLAIMS

[1]   (Cancelled)

[2]   (Amended)   A method and apparatus for priority based data processing, comprising:

a data storage apparatus that stores data comprised of a plurality of components;

an important component selection apparatus that selects a component having high importance; and

an data processing apparatus that performs data processing programmed for each component, wherein

the important component selection apparatus has a function of storing a plurality of sets of importance of a given component and a component identifier that indicates which component the importance represents, in descending order of importance, and a function of outputting a component identifier of a component having highest importance on a priority basis,

the data processing apparatus has a function of performing data processing on a component related to the component having high importance, which is indicated by the important component selection apparatus, and then updating data on the component stored in the data storage apparatus according to a result of the data processing and re-evaluating the importance of a changed component and sending out an updated value of the changed component to the important

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component selection apparatus,

the important component selection apparatus includes:

a plurality of registers;

comparators attached to the respective registers; and

5   a control circuit that controls data input/output to/from the registers and a data shift operation between the registers,

data in each register includes importance data and a component identifier,

the important component selection apparatus has a function of

10   arranging and holding the data in order of magnitude of importance and outputting most important data and moving, when the most important data has been read, the importance of rest of the data up one position,

each comparator compares magnitudes of an importance data

15   portion of a corresponding register and an importance data portion of input data and compares matching between a component identifier of data in the corresponding register and a component identifier of the input data for matching, and

based on results of the comparisons, when a same component

20   identifier as that of the input data is not present in any register, an input data control circuit additionally inserts the input data in a position between data having higher importance than the input data and data having lower importance than the input data, and when there is a register holding the same component identifier as the input data

25   and the importance data in that register is lower than the importance

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of the input data, the input data control circuit deletes data in the register and inserts the input data in a position between the data having higher importance than the input data and the data having lower importance than the input data.

5

[3] (Original) The method and apparatus for priority based data processing thereof, wherein an arithmetic circuit that performs an arithmetic process on data in the importance data portions of the respective registers is added to the important component selection

10 apparatus of claim 2.

[4] (Amended) A method and apparatus for priority based data processing thereof comprising:

a data storage apparatus that stores data comprised of a

15 plurality of components.

an important component selection apparatus that selects a component having high importance; and

an data processing apparatus that performs data processing programmed for each component, wherein

20 the important component selection apparatus has a function of storing a plurality of sets of importance of a given component and a component identifier that indicates which component the importance represents in descending order of importance and a function of outputting a component identifier of a component having highest

25 importance on a priority basis,

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the data processing apparatus has a function of performing data processing on a component related to the component having high importance, which is indicated by the important component selection apparatus, and then updating data on the component stored in the data

5 storage apparatus according to a result of the data processing and re-evaluating the importance of a changed component and sending out an updated value of the changed component to the important component selection apparatus,

the data storage apparatus holds a plurality of candidate value

10 data for each of a plurality of component data,

the data processing apparatus regards a statistic for a plurality of candidate values of a component as a representative value of the component and performs data processing specified by a program, on each component data, calculates a new updated value for each

15 component data, and then replaces a candidate value that differs most greatly from the updated value with the updated value, and

the important component selection apparatus regards the magnitude of variation in a plurality of candidate values for a component data as an importance of that component data and selects

20 an important component based on an order of magnitude of variation in candidate values.

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